Introduction

The reproduction of plants is sensitive to elevated temperature. Temperatures in the mid 30°C range decrease seed yield in a wide range of crop species, indicating a common thermal threshold may limit reproduction in the plant kingdom. A potential consequence of climate change is that the incidence of heat induced sterility may increase in areas where daily temperatures approach sterilization thresholds. Pollen abortion is often a cause of heat sterility in higher plants. It is unknown how variable the threshold temperatures are for pollen abortion within the plant kingdom. To understand the variation in sensitivity of plants to heat sterility, it is useful to study pollen abortion thresholds in plants adapted to hot climates.

Purpose of the study

The purpose of the current study is to compare the abortion rates of these two species at three temperature conditions: 27°C/25°C, 32°C/25°C, and 38°C/25°C.

Materials and Methods

• Seeds of tepary bean and coyote gourd were planted and grown outdoors.
• Young plants were then transferred to the outside environment until flowering when they were moved into controlled growth chambers. Flowers that were developed outside were removed.
• The chambers were set at 27°C/25°C, 32°C/25°C, and 38°C/25°C with a 14h photoperiod and a light intensity of about 500 µmolphotons/m²/s.
• Flowers that were entirely developed at each temperature treatment were collected.
• The anthers were dissected and stained with Alexander’s Triple Stain. The stain made viable pollen grains appear purple and aborted pollen grains appear green under the microscope.
• The abortion rate was determined as the number of aborted pollen grains per 100 randomly selected pollen grains counted.

Results

Phaseolus acutifolius at 27°C, 32°C, and 38°C

- The average abortion rates at 27°C, 32°C, and 38°C are 2.5%, 35.0%, and 78.6% respectively. There is a statistically significant difference between the two treatments (P< 0.001).

Cucurbita palmata at 27°C and 32°C

The average abortion rates at 27°C and 32°C are 20.9% and 34.1% respectively. There is a statistically significant difference between the two treatments (P= 0.018).

Conclusions

- High temperature (32°C and above) results in high abortion rates in Phaseolus acutifolius and Cucurbita palmata.
- The species in this study are known to be adapted to hot climates; yet their reproduction is compromised at temperatures higher than 32°C. Temperatures higher than 32°C may potentially threaten the reproduction of plants that are not adapted to hot climates.